FIRE DOOR CORE ASSEMBLY

Cross-Reference to Related Application

This application claims the benefit of the filing of U.S. Provisional Patent Application Serial No. 60/443,555 filed January 30, 2003.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to the art of doors and, more particularly, to the construction of a fire resistant door.

2. Discussion of the Prior Art

Doors for commercial, and even domestic, applications are often rated for fire resistance. More specifically, fire doors are rated based on their ability to resist burning in the case of a fire, with standard ratings being defined as 20, 45, 60 and 90 minutes depending on the length of time a door can withstand a rating temperature, typically in the range of 1700+ °F. The higher the minute rating, the better the fire rating. For instance, low rated fire doors are typically made from an organic material, while high rated fire doors are generally made from mineral or

metal materials. More specifically, a 20 minute door typically includes a particle or stave board core. For 45, 60 and 90 minute ratings, a wood door generally has a mineral core.

In general, the higher rated fire doors have more costly constructions. That is, while a particle board core having a density per cubic foot in the range of about 28 to 32 pounds can be easily produced without generating much dust as compare to a mineral core, is relatively inexpensive to utilize, and can be conveniently cut to desired sizes, particle board materials simply have not been able to be utilized to produce high rated fire doors. Certainly, it would be a significant advantage to be able to produce a high rated fire door from less expensive materials which are readily available, low in weight, high in mechanical strength, and easily machined.

Based on the above, there exists a need in the art for a fire door which can be economically produced, while still exhibiting a superior level of fire resistance. More specifically, there exists the need for a way to employ lower rated and less expensive fire resistant materials to produce fire doors having enhanced fire ratings.

SUMMARY OF THE INVENTION

The present invention is directed to producing a fire door which exhibits a relatively high rating, while incorporating a core material made from a material previously dedicated for use in connection with lower rated fire doors. More specifically, the present invention is concerned

with making a fire door having a core formed from an organic material, preferably a particle core, and a fire rating level of at least 45 minutes.

In accordance with the invention, a fire door includes a core including multiple panels of particle board having sandwiched therebetween a relatively thin casting of an heat insulating barrier that exhibits adhesive qualities. In accordance with the most preferred form of the invention, each one of a pair of particle board panels is initially prepared by being directed through a panel rip saw or the like which forms a plurality of thin grooves therein. The sides of the panels having the grooves are then coated with a fire retardant layer of casting material, such as perlite, gypsum, vermiculite, clay, refractory cement or the like. Once the casting material, which is bonded together with a binding material and can include a reinforcing filler such as chopped glass fibers or a fiberglass mesh, is applied so as to fill the grooves and coat the surfaces of the panels, the two panels are laminated together and pressed to a desired thickness. If necessary, the panels can be placed in a cold press until fully dried or cured. The laminated panels can then be trimmed to be used as a core in making a specified sized door.

With this construction, a fire door can be constructed with a fire rating level of at least 45 minutes out of particle board which has heretofore been restricted for use in connection with making 20 minute rated doors. Additional objects, features and advantages of the present invention will become more readily apparent from the following detailed description of a preferred embodiment when taken in conjunction with the drawings wherein like reference numerals refer to corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partial sectional view of a portion of a fire door constructed in accordance with the present invention;

Figure 2 is a cross-sectional view of the core of the fire door of Figure 1; and

Figure 3 is a perspective view illustrating a system for producing the fire door core of Figure 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With initial reference to Figure 1, a fire door constructed in accordance with the present invention is generally indicated at 2. As shown, door 2 includes an outer peripheral frame 5, constituted by interconnected rails, an upper one of which is shown at 7, and stiles, one of which is shown at 8; a core 11; an inner door skin 14; and an outer door skin 15. In general, the above construction of door 2, with the exception of the particulars of core 11, is known in the art. Therefore, these aspects of door 2 will not be discussed further here in detail.

The present invention is particularly directed to the construction and method of forming core 11. In general, core 11 constitutes a laminate including a first panel 20, a second panel 21 and an intermediate heat barrier layer 23. In accordance with the most preferred form of the

invention, each of first and second panels 20 and 21 is formed from an organic material, preferably particle board and, more preferably, softwood, hardwood, wheat, straw, flax shaves, and/or sugar cane fiber. On the other hand, intermediate heat barrier 23 constitutes a casting material, such as perlite, gypsum, vermiculite, clay, refractory cement or the like, which is bonded together with a binding material and can include a reinforcing filler such as chopped glass fibers or a fiberglass mesh.

In further accordance with the present invention, first and second panels 20 and 21 are provided with a series of grooves 30 as best represented in Figure 2. As shown, grooves 30 extend longitudinally along the entire length of only one planar side surface of each panel 20, 21, while the opposing planar side surface is substantially free of any grooves so as to define a uniform planar surface. In the most preferred form of the invention wherein core 11 is made to a standard thickness of 1.5 inches (38 mm), grooves 30 are preferably spaced center-to-center in the order of 1-4 inches (approximately 25-102 mm), more preferably 1.5-3 inches (approximately 38-76 mm) and most preferably 1.5 inches (38 mm); have a depth of approximately ¼ inch (6 mm); and exhibit a width of about 0.125 inches (3 mm). Each of first and second panels 20, 21 have a thickness in the order of 0.688 inches (17 mm) and are spaced by intermediate heat barrier 23 in the order of 0.125 inches (3 mm). Of course, these distances and dimensions are merely presented in connection with a preferred embodiment of the invention such that they can be readily altered in connection with forming other standard door thicknesses and/or custom designs.

Figure 3 illustrates a preferred manner of forming core 11 in accordance with the invention. In general, each of first and second panels 20 and 21 are placed upon a conveyor 42 and initially directed through a panel rip saw 44 for use in connection with forming grooves 30. Next, each of first and second panels 20, 21 are directed through a coating apparatus 48 at which the first and second panels 20 and 21 are coated with heat barrier layer 23. In general, this step can be performed in various ways, including spraying, pouring, painting and the like. In any case, the heat barrier layer 23 is applied so as to fill grooves 30 and coat respective surfaces of first and second panels 20 and 21. Thereafter, the panels are transferred to tables 50 and 56 as illustrated in Figure 3 with respect to previously coated panels 20' and 21'. At this point, one panel 20', 21' can be covered with a thin fiberglass mesh (not shown). Preferably, heat barrier layer 23 is allowed to cure in order to have a paste-like consistency. As indicated by the arcuate arrow in this figure, panel 21' is then flipped atop panel 20'. In this manner, panels 20' and 21' are laminated together to form core 11. Although not shown, the panels 20' and 21' can be pressed to a desired thickness. For instance, core 11 could be placed in a cold press until fully dried or cured. Core 11 can then be trimmed on any or all of its four sides for use in making a specified sized door 2, such as with the addition of frame 5 and inner and outer door skins 14 and 15.

With this arrangement, it has been found that the particle core 11 achieves at least a fire rating level of 45 minutes. Although particle board was heretofore limited for use in connection with making 20 minute fire doors, the addition of the heat barrier 23 establishes a special thin casting that has been found to reduce burning. Therefore, a relatively

inexpensive door 2 can be formed in accordance with the present invention which exhibits low weight, high mechanical strength, exceptional bonding with a wide range of adhesives, the ability to readily be cut to various sizes, easy machining characteristics, and low dust generation during machining as compared to more expensive mineral cores and the like. The inclusion of grooves 30 enhances the mechanical strength of heat barrier 23, which defines a separating layer for panels 20 and 21 while also extending into the body of each panel 20, 21. In addition, with the casting material of intermediate heat barrier layer 23 extending into grooves 30 in each panel 20, 21, the invention ensure that the casting material will remain as long as possible to the particle board panel 20, 21 on the unexposed side of a burning door 2, thereby further reducing heat penetration through door 2.

Although described with reference to a preferred embodiment of the invention, it should be readily understood that various changes and/or modifications can be made to the invention without departing from the spirit thereof. For instance, although grooves 30 in accordance with the most preferred embodiment of the invention are constituted by spaced, longitudinally parallel cuts, it is possible in accordance with the invention to provide additional cross or angled cuts, or even to rout grooves in other configurations. In addition, instead of spraying or pouring heat barrier 23 on panels 20 and 21, heat barrier 23 could be defined by a preformed sheet that is placed between and adhered to panels 20 and 21, along with a thin casting or adhesive still filling grooves 30. In any case, it should be readily apparent that a fire door constructed in accordance with the present invention can be made in various ways to produce a door having a

relatively high fire rating from materials which have only been previously utilized in connection with lower rated fire doors.